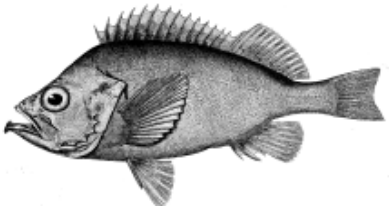

Redfish

by

Ralph Mayo

Redfish or ocean perch, *Sebastes* spp., are distributed throughout the North Atlantic from the coast of Norway to Georges Bank. Off New England, *Sebastes fasciatus* are most common in deep waters of the Gulf of Maine to depths of 300 m (975 ft). Redfish are slow growing, long-lived animals with an extremely low natural mortality rate. Ages in excess of 50 years and maximum sizes of 45 to 50 cm (18 to 20 in.) have been noted. In the Gulf of Maine, redfish reach maturity in about 5 to 6 years at an average length of 20 to 23 cm (8 to 9 in.). Females are viviparous, retaining eggs in the ovary after fertilization until yolk-sac absorption. Mating takes place in autumn, with subsequent larval extrusion occurring the following spring and summer.

Redfish are managed under the New England Fishery Management Council's Northeast Multispecies Fishery Management Plan (FMP). Under this FMP redfish are included in a complex of 15 groundfish species which has been managed by time/area closures, gear restrictions, minimum size limits, and, since 1994, direct effort controls including a moratorium on permits and days-at-sea restrictions under Amendments 5 and 7 to the FMP. Amendment 9 established biomass rebuilding targets, and defines control rules which specify target fishing mortality rates and corresponding rebuilding time horizons. The goal of the management program is to reduce fishing mortality to levels which will allow stocks within the complex to initially rebuild above minimum biomass thresholds, and, ultimately, to remain at or near target biomass levels.

The principal commercial fishing gear used to catch redfish is the otter trawl. Recreational catches are insignificant. During the early development phase of the Gulf of Maine fishery, U.S. nominal catches rose rapidly to a peak level of about 60,000 mt in 1942 followed by a steep decline through the early 1950s. Nominal catches declined more gradually to less than 10,000 mt during the 1960s, and then increased, peaking at 20,000 mt in 1971 and again at 14,800 mt in 1979. Landings then declined steadily throughout the 1980s, and have remained below 1,000 mt per year since 1989. Landings of Gulf of Maine redfish by Canadian vessels have been negligible.

The standardized catch per unit effort (CPUE) index declined from 6.1 mt per day in 1968 to approximately 2.4 mt per day between 1975 and 1978, and to less than 1.0 mt per day since 1987.

The NEFSC autumn bottom trawl survey biomass index declined from 40.4 kg per tow in 1968 to an average of 3.8 kg per tow during 1982-84, a 91% reduction. This index subsequently averaged 10.0 kg per tow during 1990-1993, increased substantially to 30.6 kg per tow in 1996, and remained relatively high in 1997 and 1998.

Increases in the survey biomass index between 1990 and 1993 are consistent with incremental annual increases in the NEFSC survey abundance index (mean number per tow) observed during the early 1990s, and reflect accumulated recruitment and growth of one or more above-average year classes produced in the mid-1980s. The large increase in the survey biomass index in 1996 was supported almost exclusively by fish in the 18-23 cm range at a corresponding age of approximately 5-6 years. Production of these redfish is likely to have occurred during 1990 and 1991, with reproduction augmented by early-maturing spawners from the mid-1980s year classes. Thus, stock biomass appears to have increased during the mid-1990s through the combined effects of growth and survival of fish from a period of relatively successful reproduction in the early 1990s. Further increases in biomass since 1996 have been supported by a wide range of sizes of fish in the population.

Estimates of exploitable biomass (ages 5 and older) derived by virtual population analysis or VPA declined by 76%, from 136,000 mt in 1969 to a projected 32,000 mt in 1985. Projections are not available for subsequent years. Fishing mortality during the 1970s was slightly greater than F_{max} (0.13, 12% exploitation rate) and twice the $F_{0.1}$ level (0.06, 6% exploitation rate). During the late 1970s, the combination of declining stock size and increased fishing effort on the 1971 year class produced fishing mortality rates that were 50 percent greater than F_{max} and three times higher than $F_{0.1}$. Fishing mortality has declined in recent years to a level less than or equal to $F_{0.1}$, and well below F_{max}. Equilibrium surplus production models have indicated that the long-term potential catch from the stock (MSY) is about 14,000 mt. Given the low population biomass and poor recruitment during most of the 1980s, surplus production in the near future will remain considerably less than 14,000 mt.

Landings since 1989 have been extremely low (less than 900 mt/yr), reflecting low levels of stock abundance and fishing mortality. Recruitment has been poor throughout the 1970s and 1980s, except for the moderate to strong 1971 and 1978 year classes and some modest recruitment from the mid-1980s and early 1990s. Stock biomass increased steadily through the mid-1990s, and has increased considerably since 1996 . However, most of the redfish supporting the recent increase in biomass have been small, immature fish produced in the early 1990s, and have yet to realize their full growth and reproductive potential. If fishing mortality on these young fish increases significantly in the near-term, stock biomass may decline to levels observed during the 1980s. As current biomass levels are below the SFA minimum biomass threshold, the stock is considered to be in an overfished condition.

For further information

Mayo, R. K. 1980. Exploitation of redfish, *Sebastes marinus* (L.), in the Gulf of Maine-Georges Bank region, with particular reference to the 1971 year class. J. Northw. Atl. Fish. Sci. 1: 21-38.

Mayo, R.K. 1987. Recent exploitation patterns and future stock rebuilding strategies for Acadian redfish, *Sebastes fasciatus* Storer, in the Gulf of Maine-Georges Bank region of the Northwest Atlantic. *In*: Proceedings of the International Rockfish Symposium, B. R. Melteff, coordinator, p. 335-353. Anchorage, Alaska, October 20-22, 1986. Fairbanks, AK: University of Alaska Sea Grant College Program. Alaska Sea Grant Report 87-2.

Mayo, R.K. 1993. Historic and recent trends in the population dynamics of redfish, *Sebastes fasciatus* Storer, in the Gulf of Maine-Georges Bank Region. Northeast Fish. Sci. Cent. Ref. Doc. 93-03.

Northeast Fisheries Center. 1986. Report of the Second NEFC Stock Assessment Workshop (Second SAW). Northeast Fish. Sci. Cent. Ref. Doc. 86-09. 114 p.

Summary Status

Long-term potential catch (MSY)	=	14,000 mt
Biomass corresponding to MSY	=	B_{MSY} = 121,000 mt
Minimum biomass threshold	=	$^1/_2$ B_{MSY} = 60,500 mt
Stock biomass in 1998[1]	=	54,000 mt (Implies an overfished condition)
F_{MSY} [2]	=	$F_{20\%}$ = 0.116
F_{TARGET} [2, 3]	=	0.070
$F_{TARGET98}$ [2]	=	0.00
Overfishing definition	=	$F_{THRESHOLD98}$ [2, 4] = 0.116
F_{1998} [2]	=	Unknown
Age at 50% maturity	=	5.5 yrs, both sexes
Size at 50% maturity	=	21 cm (8.3 in.), males 22 cm (8.7 in.), females
Assessment level	=	Production Model / Index
Management	=	Northeast Multispecies FMP

M= 0.050 **$F_{0.1}$= 0.060** **$F_{20\%}$=0.116** **F_{max}= 0.132**

[1] Average 1996-1998 survey swept area biomass proxy.

[2] Fully-recruited F.

[3] At B_{MSY}, defined as 60% of F_{MSY}

[4] $F_{THRESHOLD}$ = $F_{20\%}$ = 0.116 when stock biomass is above B_{MSY} = 121,000 mt, and F should fluctuate around the target value (0.07). At stock biomass levels between B_{MSY} and ½ B_{MSY} = 60,500 mt, $F_{THRESHOLD}$ and F_{TARGET} decline linearly to zero. When stock biomass is below ½ B_{MSY}, F should be as close to zero as practicable.

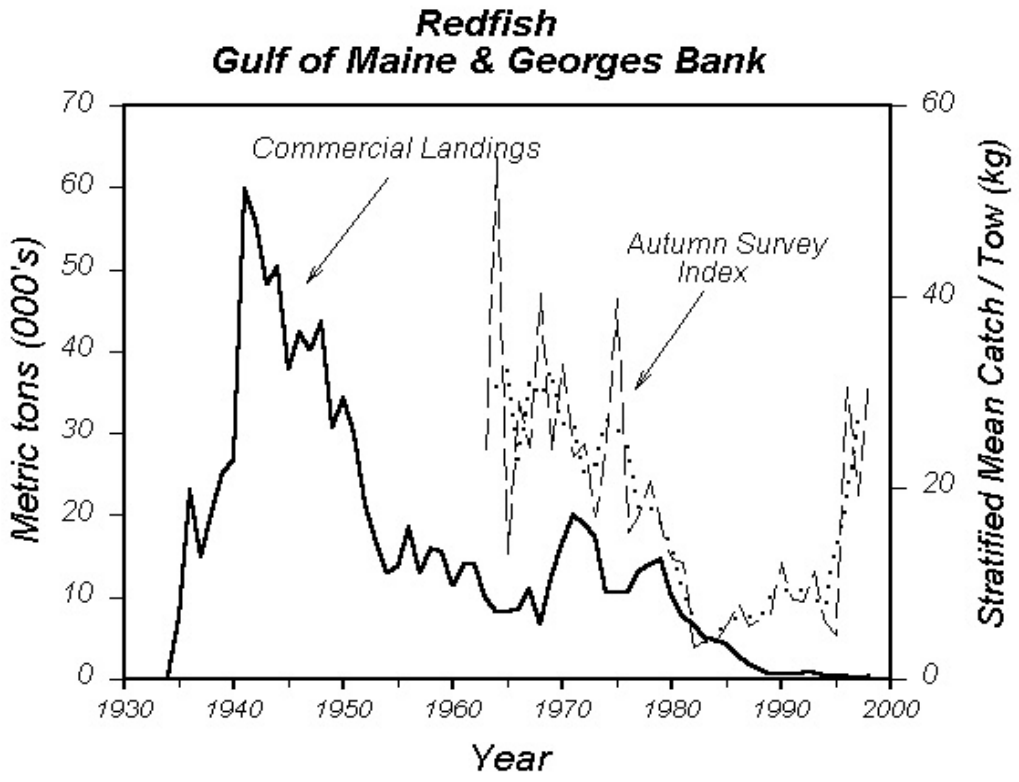

Table 3.1 Recreational and commercial landings (thousand metric tons)

	Year										
Category	**1979-88 Average**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
U.S. recreational	-	-	-	-	-	-	-	-	-	-	-
Commercial											
United States	5.9	0.6	0.6	0.5	0.8	0.8	0.4	0.4	0.3	0.2	0.3
Canada	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Other	-	-	-	-	-	-	-	-	-	-	-
Total nominal catch	6.0	0.6	0.6	0.5	0.8	0.8	0.4	0.4	0.3	0.2	0.3